

AIRS Pulse Tube Coolers Performance Update – Twenty Years in Space

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The Atmospheric Infrared Sounder (AIRS) instrument began operation 39 days after its May 4, 2002 launch into Earth orbit. It has now completed over twenty years of successful operation using a pair of Northrop Grumman pulse tube cryocoolers to cool its IR detectors. Designed with redundant cryocoolers (a primary and a backup), the instrument began operation using a single cooler to bear the load of both the detector and the nonoperating, backup cooler. However, 6 months after launch, a change in operating strategy was made to run both coolers simultaneously. This change led to the successful continuous 24/7 operation of both coolers over the past 19½ years. After a brief review of the AIRS instrument cryogenic design, detailed data are presented on the highly successful continuous operation of the AIRS pulse tube cryocoolers and instrument thermal design. A valuable feature has been the extremely stable temperatures provided to the instrument over its lifetime. This high level of operational stability not only indicates that the cryocoolers and thermal design have maintained near-constant efficiency, but the stability has also provided enormous benefits to the science data in terms of tracking long-term global changes. During its 20-year lifetime, the instrument itself has evolved in its mission scope and expanded its data gathering well beyond its original role as just a temperature sounder measuring global daily air temperature. It now generates a wealth of data not only on global air temperatures, but also on global and local greenhouse gas distributions. For example, AIRS can detect carbon monoxide emissions from large forest fires and can follow their giant plumes as the gas moves across the planet. At this time the cryocoolers continue in 24/7 operation and the AIRS instrument continues to generate daily scientific data on Earth's atmospheric parameters.